

REVISION OF THE EXTRA-AUSTRALIAN SPECIES OF  
*ACACIA* subg. *HETEROPHYLLUM*

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SUMMARY

Descriptions and a key for the identification of 18 species, ten of which do not occur in Australia, are given. *A. wetarensis* and *A. solandri* subsp. *kajewskii* are described as new and *A. simplex*, based on *Mimosa simplex* Sparrm. is a new combination for the species previously known as either *A. laurifolia* Willd. or *A. simplicifolia* (L.f.) Druce. *A. koaia* is treated as a synonym of *A. koa*. *A. solandri* subsp. *solandri* is recorded from New Guinea while *A. solandri* subsp. *kajewskii* is confined to the New Hebrides. *A. quadrilateralis* was erroneously recorded from Timor by Decaisne and *A. willardiana* from Mexico is excluded from subgenus *Heterophyllum*. Related species, widely separated geographically, pose phytogeographical problems.

DISTRIBUTION AND RELATIONSHIPS

It is generally agreed (Darlington, 1965; Burbidge, 1960) that Australia has been isolated from other continents since the end of the Cretaceous, and that regardless of how or by what route the genus *Acacia* arrived, the large number of species (ca 700) has evolved within the continent. The phyllodine species do not occur on the mainland of any other continent and it is reasonable to suppose that any species of *Acacia* with phyllodes now occurring outside of Australia have either come from the Australian region or have been derived from species which have.

*Acacia* has no special means of dispersal, though the pods of *A. farnesiana* may be transported by water. The seeds are however hard, remain dormant for a long period (see Everist, 1949) and resist digestion by animals. It may be significant that many of the species considered here are components of strand vegetation. They could be carried by animals, especially birds. The conspicuous

aril of some species such as *A. oraria*, *A. cyclops* and *A. salicina* is thought by some to attract birds and may account for the presence of *A. oraria* in Timor and Flores though it is difficult to account for its absence from New Guinea where strands suitable to its growth exist. Despite the difficulty in postulating a mechanism of spread or of envisaging a spread over long stretches of water, the fact is that the species are widely dispersed. The whole flora of Hawaii is believed to have been derived from plants which made such long over-water journeys (Fosberg, 1948).

The pollen morphology of *A. mangium* and *A. simplex* (Guinet, 1969) indicates that they are less advanced members of subg. *Heterophyllum*. The grains have four pores but no furrows and are therefore similar to those of subg. *Aculeiferum*. From the present geographical range of these species a reasonable inference might be that subg. *Heterophyllum* first became established on the northern part of the Australian plate (Raven & Axelrod, 1971). This matter will be discussed at greater length elsewhere. Subsequent fragmentation of the plate has resulted in the isolation of some species but no detailed explanation can be offered for the present dispersal of species in the Indo-Pacific region. Some of the uncertainty may be removed when pollen of other species of subg. *Heterophyllum* is examined.

*Acacia mangium* is probably not closely related to other juliflorous species. *A. spirorbis* may be a relict species isolated in New Caledonia after fragmentation of the Australian plate, and the present disjunct range of *A. solandri* may also be the remnants of a former wider range in the north-eastern part of the plate. *A. aulacocarpa*, *A. auriculiformis* and *A. crassicarpa* comprise a set of fairly closely related species which probably originated in the north of the Australian region. All the species have a wide range in northern Australia including the northern parts of Arnhem Land (despite map in Hoogland, 1972), with *A. aulacocarpa* extending down the eastern coast into New South Wales. *A. wetarensis* is confined to Wetar but shows some relationship to *A. auriculiformis* which occurs in the Kei Is about 700 km to the east.

The dispersal of the species with capitate inflorescences is wider than that of the juliflorous species and even more difficult to elucidate. *A. oraria*, a strand species of north-eastern Queensland, is probably a comparatively recent introduction to Timor and Flores. Its absence from the Northern Territory is unexpected. *A. simplex* has pollen similar to that of *A. mangium* and is probably primitive. It has dispersed as far east as Samoa. It is a strand species but has evidently been established in the Fijian Is for a long period as *A. mathuataensis*, a little known rain-forest species, has developed from it.

*A. confusa*, *A. richii* and *A. simsii* are related to each other and more distantly to *A. simplex* and the Australian endemic *A. complanata* both of which have unfurrowed (presumably primitive) pollen. *A. simsii* is widely distributed in northern Australia, occurring as far south as about Townsville and ranges

as far north as the northern coast of New Guinea. *A. confusa* and *A. richii* are geographically remote from each other and from *A. simsii*, *A. confusa* occurring in the northern Philippines and *A. richii* being confined to Fiji. Dispersal of *Acacia* from northern New Guinea to the Philippines or from north-eastern Australia to Fiji is difficult to conceive, but considering the large number and great diversity of species on the Australian continent it is perhaps more surprising that there are so few widespread species.

The greatest problem confronting the phytogeographer is the ranges of the remaining species. Two species occur in the Hawaiian Is, and two in the western Indian Ocean at about the same latitude in the southern hemisphere, usually not at low altitudes. *A. heterophylla* and *A. koa* though endemic to areas 15 000 km apart are so similar morphologically that, were it not for the great spatial separation, one would probably consider them conspecific.

Carlquist's (1965) statement that both *A. koa* and *A. heterophylla* are probably descendants of seeds which floated into the Indian and Pacific Oceans, respectively, from Australia, may be true but it leaves unsolved problems. Both species are tetraploid and therefore probably not primitive. If both arose from a common ancestor such as *A. melanoxyton* which usually grows on highlands but may occur near the sea, or a species related to *A. melanoxyton*, the fact is that the locality nearest to the Hawaiian Is able to support such a species is the Samoan Is more than 4 000 km away and the nearest such locality to Mauritius is Malesia 5 000 km away. *A. simplex* occurs in Samoa, but neither locality has a species related to *A. koa* or *A. heterophylla*. That *Acacia* subg. *Heterophyllum* has become extinct in areas, remote from the Australian region, where it was formerly widespread is possible, but in the tropics where high mountains afford a range of habitats, it is considered unlikely.

## TAXONOMY

### KEY TO *Acacia* SUBG. *Heterophyllum* OUTSIDE AUSTRALIA.

#### FLOWERS IN HEADS

Phyllodes with crowded nerves, (1-) 3-5 prominent, the secondary ones anastomosing; heads in axillary racemes, sometimes condensed to a single articulate axillary peduncle.

Phyllodes falcate, obovate, obtuse, 5-8 cm long, 2-3.5 (-6) times as long as broad; branchlets, young phyllodes and developing inflorescences covered with white bloom.

1. *A. oraria*

Phyllodes, often more than 8 cm long and more than 6 times as long as broad, usually acute or if obtuse then more elongate; phyllodes and branchlets not covered with white bloom.

Corolla less than 2 mm long; phyllodes up to 7.5 cm long, 8-12 mm broad, with secondary nerves conspicuously anastomosing to form  $\pm$  regular pattern, the nerve-islands oblong.

2. *A. xiphoclada*

Corolla 2 mm or more long; phyllodes usually more than 7.5 cm long and more than 12 mm broad, with secondary nerves anastomosing but not forming regular net.

Heads usually on short (less than 1 mm) long axillary peduncles, rarely in 3-branched racemes. 3. *A. heterophylla*

Heads in 2-7 branched racemes, the axis (2-) 5-12 mm long, the racemes sometimes in compact terminal panicles.

Heads in terminal panicles; calyx lobes tomentose. 4. *A. kauaiensis*

Heads in 2-3 branched axillary racemes, sometimes growing out into leafy shoots; calyx not tomentose. 5. *A. koa*

Phyllodes with rather widely spaced major nerves with faint anastomosing nerves between them. Inflorescences reduced to groups of axillary flowers (usually 2 groups of 2) or occasionally 2-branched axillary raceme with short axis.

Phyllodes up to 2.5 times as long as broad, up to 7.5 cm broad.

Phyllodes 5-12 cm long, 2.5-7.5 cm broad. 6. *A. simplex*

Phyllodes 3.5-5 cm long, 1.5-2.5 cm broad. 7. *A. mathuataensis*

Phyllodes at least 4 times as long as broad, up to 2 cm broad.

Phyllodes 5-19 mm broad, 4-9 times as long as broad; heads of about 10 flowers; pod 12-24 mm broad, seeds transverse. 8. *A. richii*

Phyllodes 5-9 mm broad, usually more than 10 times as long as broad; heads of 25-30 flowers; pod to 10 mm broad, seeds longitudinal.

Calyx 1-1.3 mm long, corolla 1.5-1.9 mm; pod 1 cm broad. 9. *A. confusa*

Calyx 0.6-0.8 mm long, rarely 1 mm long, corolla 1.3-1.5 mm long; pod to 7 mm broad. 10. *A. simsii*

#### FLOWERS IN SPIKES

Branchlets stout and angular; phyllodes with 3-5 prominent longitudinal nerves running together near base with secondary nerves forming fine reticulum; pods linear, coiled, turgid.

11. *A. mangium*

Branchlets slender; phyllodes without anastomosing secondary nerves or secondary nerves slightly anastomosing or if forming fine reticulum then pods not linear and turgid.

Pods 13 mm or more broad with transverse seeds, often transversely veined and margins undulate.

Secondary nerves parallel, not at all anastomosing; pods 2 cm or more broad not undulate when mature but sometimes so when old.

Pod woody, transversely but hardly reticulately nerved, 2-3.5 cm broad; calyx 0.5-0.7 mm long, corolla 1.3-1.6 mm long; major nerves and margins of phyllodes somewhat yellowish. 12. *A. crassicarpa*

Valves of pods cartilaginous or woody, transversely reticulately nerved, ca 2 cm broad; calyx 0.7-1 mm long, corolla 1.5-1.9 mm long; major nerves and margins not markedly yellow. 13. *A. aulacocarpa*

Secondary nerves at least occasionally anastomosing; pods with undulate margins, up to 1.5 cm broad.

Phyllodes more than 10 cm long, the secondary nerves forming only a few anastomoses; spikes more than 4 cm long; calyx 0.7 mm or more long.

14. *A. auriculiformis*

Phyllodes less than 12 cm long, the secondary nerves forming fine reticulum (sometimes obscured by tissue of phyllode); spikes *ca* 2 cm long; calyx *ca* 0.5 mm long. 15. *A. wetarensis*

Pods up to 10 mm broad sometimes transversely nerved when immature, coiled but without crenate margins; seeds longitudinal or slightly oblique.

Pod up to 3 mm broad, coiled; phyllodes 10–25 mm broad, 6–16 times as long as broad with 3 major longitudinal nerves and widely spaced secondary nerves; pulvinus (3–) 5–10 mm long; spikes moderately dense 16. *A. leptocarpa*

Pod 3.5–10 mm broad, closely coiled when narrow, less so when broad; phyllodes 6–16 mm broad, 7–24 times as long as broad, with 2 major long nerves (3 when broad); pulvinus 2–4 mm long; spikes open.

Phyllodes  $\pm$  straight 6–11 cm long, 7–12 times as long as broad; pod 8–10 mm broad. 17. *A. spirorbis*

Phyllodes curved (usually) 10–17 cm long, 9–24 times as long as broad; pod to 5.5 mm broad. 18. *A. solandri*

Phyllode broadest below middle, attenuate to apex; pod raised over seeds, rather tightly coiled; seeds  $5 \times 2.5\text{--}3.5$  mm.

*A. solandri* subsp. *solandri*

Phyllode broadest above middle tapering equally to each end; pod  $\pm$  flat, loosely coiled; seeds  $3.5\text{--}4.5 \times 2\text{--}2.5$  mm.

*A. solandri* subsp. *kajewskii*

1. **Acacia oraria** F. Muell. Fragm. 11 : 66 (1879). Syntypes: Rockingham Bay, *Dallachy* (MEL, holo.; BM, iso.); Trinity Bay, *Bailey* (BRI, iso.).

*A. oraria* F. Muell. var. *amblyphylla* Domin, Biblioth. Bot. 85 : 265 (1926). Type: In silvis mixtis apud opp. Cairns solo arenoso, Dec 1909, *Domin* (PR, holo.).

Spreading tree about 10 m tall with fibrous fissured bark; branchlets angular, covered with whitish bloom. Phyllodes rather thick obovate falcate, lower margin  $\pm$  straight, upper curved, broadest above the middle, attenuate at the base, obtuse, at first covered with white bloom, glabrous 5–8 (–10) cm long, (10–) 15–35 (–45) mm broad, 2–3.5 (–6) times as long as broad; three prominent longitudinal nerves with about six secondary longitudinal ones, reticulately nerved between them forming  $\pm$  square vein islands; gland basal, small but with a well defined rim; pulvinus 3–6 mm long. Heads, at first covered in white bloom, of 30–40 flowers in axillary or sometimes terminal 3–5 branched racemes, sometimes growing out into leafy shoots, the axis 8–18 mm long, peduncles 4–7 mm long. Flowers 5–merous; calyx lobes united to about the middle, 1–1.4 mm long, oblong, obtuse; corolla lobes rather narrow, united to the middle, 1.5–1.9 mm long, 1.3–1.8 times as long as the calyx; stamens 3–4 mm long; ovary somewhat scurfy. Pod flat with nerved margins, twisted or coiled, to 12 cm long, 9–15 mm wide, scurfy; seeds longitudinal *ca* 4 mm long and 3 mm broad; areole rather large, closed; funicle translucent, red, thickened, passing completely round seed then folded back on itself and considerable thickened to form the hilum, occasionally folded only  $\frac{3}{4}$  way around seed.

Range: Eastern coast of Queensland north of 20° S latitude, Flores and Timor.

LESSER SUNDA Is.: Flores: Nimang, Oct 1966, *Schmutz* 550 (L). Timor: Oeolu, Jun 1968, *Schmutz* 2296 (L); Atambua, *van Beloe* (L); in 1905, *Teysmann* 7943 (BRI, L) & 7945 (L).

**2. *Acacia xiphoclada* Baker, J. Linn. Soc. (Bot) 22 : 468 (1887).** Syntypes: Central Madagascar, *Baron* 1695 (K, BM) and 4384 (K).

Tree (?) with slender angular glabrous or somewhat scurfy branchlets; stipules extremely small and not long persisting. Phyllodes glabrous straight mucronulate, 43–73 mm × 8–12 mm, 5.5–8 times as long as broad; 3–5 major longitudinal nerves with moderately dense, strongly anastomosing secondary nerves between them making a regular network, the areoles rectangular *ca*  $\frac{1}{4}$  mm broad and 1–2 mm long; gland small basal or up to 2.5 mm from base; pulvinus 2–3 mm long. Heads of 25–30 flowers in glabrous or scurfy axillary 2-branched racemes which often grow out into leafy shoots so that the peduncles appear lateral, axis 5–10 mm long, peduncles 2.5–5 mm long; bracteoles capitate about as long as calyx. Calyx 1.2 mm long, united almost to top or with obtuse incurved lobes *ca* 0.2 mm long with indumentum of small brown sessile or shortly stalked globular trichomes; corolla glabrous except sometimes at apex becoming free to base, 1.8–1.9 mm long, 1.5–1.6 times as long as calyx; stamens 2.5–3 mm long; ovary silky pubescent, absent from the flowers of some heads. Pod unknown.

Range: Madagascar.

CENTRAL MADAGASCAR: Andrangalooka, Jan 1881, *Baron* 459 (K, BM).

There is a strong similarity in the size of the phyllodes and the structure of the inflorescence and flower between this and *A. cyclops*, but the venation is quite different, resembling more that of *A. melanoxyton* or even *A. dictyophleba*.

**3. *Acacia heterophylla* Willd. Sp. Pl. 4 : 1054 (1806), based on**

*Mimosa heterophylla* Lam. Encyclop. 1 : 14 (1783). Type: Bourbon, *Commerson* (G, K, iso.).

*A. brevipes* A. Cunn. Bot. Mag. t.3358 (1834); *syn. nov.* Type: Hort. Kew (K, holo).

Tree to 10 m; branchlets slender, angular with sparse appressed hairs, glabrescent; stipules extremely small. Phyllodes straight or curved glabrous, 7.5–13.5 cm long (16.5 in cultivated specimens), 7–13 mm broad, 8–20 times as long as broad; 1 or more commonly 3 longitudinal nerves more prominent than rest, many (3–4 mm) secondary longitudinal nerves, anastomosing; gland rather large, basal; pulvinus 2–3.5 mm long. Heads of 30–40 flowers on scurfy peduncles 5–7 mm long, the

peduncle usually on a short axillary shoot (much less than 1 mm long) and usually subtended by small bract. Flowers pale; calyx 1.2–1.4 mm long with inrolled obtuse pubescent lobes up to 0.2 mm long; corolla 2.0–2.4 mm long, 1.7 times as long as calyx, divided to middle, lobes pubescent; stamens 3.5 mm long; ovary tomentose. Pod (immature) flat, *ca* 6–7.5 cm long, 6 mm broad, glabrous; seed longitudinal with a funicle folded not thickened at base of seed, shield open.

Range: Mascarene Is.

REUNION Is.: Riviere des Ramparts, Nov 1968, *Barclay* 1254 & 1255 (K) Plaine des Cafres, Jul 1961, *St. John* 26510 (K, G).

MAURITIUS: without definite locality *Balfour* (K); in 1847, *Richard* 393 (TCD); *Richard* (P).

4. *Acacia koa* A. Gray, Bot, U.S. Explor. Exped. 1 : 480 (1854). Syntypes: Oahu: on the mountains behind Honolulu (K, iso). On the sides of Mt. Loa and Mt. Kea (K, iso).

*A. heterophylla* Willd. var. *latifolia* Benth. Lond. J. Bot. 1 : 369 (1842). Type: Ins. Owhyhee, ad montem Kaah, Jun 1825, *Macrae* (K, holo).

*A. koaia* Hilleb. Fl. Haw. Is. 113 (1888). Syntypes: Manai: Kula, *Hillebrand* & *Lydgate*, ex herb *Lydgate* (BISH, iso.) Molokai: without definite locality, ex Mus. Bot. Berlinensi (BISH, ?iso.).

*A. koa* A. Gray var. *hawaiiensis* Rock, Bot. Bull. Board Agr. Forestry, Hawaii 5 : 23 (1919). Type: *Rock* 12866 (BISH, holo.).

*A. koa* A. Gray var.  $\beta$  Hilleb. Fl. Haw. Is. 113 (1888). Type: Without definite locality, ex herb. *Hillebrand* (BISH, iso.).

*A. koa* A. Gray var. *lanaiensis* Rock, Bot. Bull. Board Agr. Forestry, Hawaii 5 : 21 (1919), based on *A. koa* A. Gray var.  $\beta$  Hilleb.

*A. koa* A. Gray var. *weimeae* Hochr. Candollea 2 : 377 (1925). Type: Kauai: Weimea, Feb 1905, *Hochreutiner* 3612 (G, holo.).

Tree to *ca* 12 m tall; branchlets ribbed, glabrous or scurfy, rarely puberulous, the older ones with prominent lenticels, some golden pubescence on young plants. Phyllodes falcate or occasionally straight when small, broadest below the middle, or above the middle when small, acute or obtuse mucronulate, with 2, 3 or 4 prominent longitudinal nerves free to the base and many less prominent parallel secondary nerves, somewhat anastomosing, 5–20 (–27) cm long, 6–35 mm broad, 3–22 times as long as broad, gland large, basal or occasionally up to 8 mm from the base; pulvinus (2–) 5–8 mm long. Heads of 20–40 flowers on scurfy and occasionally puberulous peduncles 5–12 (–14) mm long in 2–7 branched racemes in the upper axils, occasionally forming small terminal panicles the axis (2–) 5–12 mm long, scurfy. Flowers 5–merous;

calyx 1-1.6 mm long, the lobes obtuse, up to 0.4 mm long, glabrous at base with brownish and some hyaline hairs on the lobes; corolla 2-2.7 mm long, 1.3-2 times as long as the calyx, lobes united to the middle, glabrous or with a few hairs towards the top; stamens 3-4 mm long; ovary tomentose, glabrous when rudimentary. Pod flat, finely transversely veined, glabrous (8-) 11-20 cm long, 6-25 mm broad, seeds transverse or when pod less than about 12 mm broad, longitudinal, 5.5-10 mm  $\times$  3.5-5.5 mm, with a large open areole and a loosely folded but hardly thickened funicle.

Range: Hawaiian Is.

HAWAII: 4 miles from Kamuela towards Kohala, Mar 1930, *Degener et al.* 3899 (BISH); Puu Waawaa near Puuanahula Bluff, Nov 1922, *Skottsberg* 1112 (BISH); behind Waimea, Jul 1909, *Rock* 3984 (BISH); 1 mile N of Kamuela on road to Kohala, Jul 1966, *Carlquist* 2078 (BISH); Waiohinu Kau, Aug 1927, *Rust* (BISH); Kau, slope of M. Loa, forests above Kohala, Sep 1922, *Skottsberg* 589 (BISH); Kilaue-Mauna Loa road, Sep 1938 *Cranwell et al.* 3280 (BISH, K); Kilauea, *Forbes* (BISH); Kipuku Puauulu, Aug 1959, *Stone* (BISH); Pulehua, S. Kona, Jul 1912, *Rock* 12866 (BISH); Laumaia, Aug, 1935, *Neal & Hartt* 828 (BISH); NW of Papaloa, Captain Cook, Kona, Aug 1949, *Degener & Mairashije* 20326 (BISH, K, BRI, G).

OAHU: Honouliuli, Waianae Mts, May 1936, *Fosberg* 13098 (BISH); Pupukae-Kahuku trail, Paumalu, May 1931, *St. John* 11098 (BISH, K, P); S of Kaiwikolle, Mar 1926, *Degener & Degener* 30485 (BISH); Waianae Mts, Dupont Trail, Dec 1952, *Chock* 813 (BISH); Koolau Mts, Waimae, Pupukea-Kahuku road, Mar 1953, *Chock* 879 (BISH); between Palolo Valley and Waialae Nui Valley, Aug, 1933, *Fosberg* 9711 (BISH); Mt. Tantalus, Aug 1922, *Skottsberg* 63 (BISH); Mt. Tantalus 21° 20' N, 157° 49' W, Jun 1964, *Crosby & Anderson* 1377 (BISH); Mt. Tantalus, Apr 1925, *Hochreutiner* 3647 (G); Koolau Mts, Waialae, Waialae-iki, Mar 1956, *Stone* 1206 (BISH); Koolau Mts, Waikane-Schofield trail, Waikane, Jan 1930, *St. John* 10160 (BISH, P); Honolulu, Jul 1932, *Russell* 35 (BISH); Puu Kanehoa, Waianae Mts, Honouliuli, Mar 1931, *Inafuku* (BISH); Mt. Kaala, in 1897, *Guppy* (K); ridge S of Kaiwikoele, Mar 1966, *Degener & Degener* 30484 (K, BISH); without definite locality, in 1850, *Seeman* 2293 (K).

MAUI: Flats NE of Puu Nianiau, Haleakala, Apr 1952, *Degener* 22323 (BISH); Keali forest S slope of Haleakala, Mar 1920, *Forbes* 2119M (BISH, P) & 2127M (BISH, P); along Hana Highway between Keanae and Hanna, Oct 1971, *Nagata* 900 (BISH); Kipahulu, summit of W ridge of Kaukua gulch, Dec 1936, *St. John and Calto* 17814 (BISH, BRI, K); S slope of Haleakala, Dec 1948, *Degener & Clay* 19322 (BISH).

LANAI: Wai'akeakua, Jul 1910, *Rock* 8029 (BISH, P); SE corner of Palawai Basin, Mar 1927, *Munro* 44, Jun 1927, *Munro* 45 and Nov 1913, *Munro* 78 & 193 (all BISH); Paomai, Aug 1918, *Munro* 672 (BISH).

MOLOKAI: Near Mapulehu, Apr 1910, *Rock* 7004 (K, BISH, P); hill east of Kahanui, Jul 1912, *Forbes* 258Mo (BISH, K); Kahanui, Jul 1912, *Forbes* 256Mo (BISH).

KAUAI: Kaholuaniano, Oct 1911, *Rock* 2755 & 2755f (BISH); Waimea Canyon, Aug 1969, *Henrickson* 4042 (BISH); Kokee, Mar 1963, *Krauss* 889 (BISH); Wailua Falls, Oct 1916, *Forbes* 503K (BISH); Halemanu, Feb 1909, *Rock* 2154 (BISH); Waimea, No Pali-Kona forest reserve, Aug 1953, *Chock* 882 (BISH, K); W of Keopaweo, Nawiliwili, Jan 1952, *Degener* 21537 (BISH); Hanalei Valley, Jan 1950, *Degener & Hatheway* 21405 (BISH); behind Wai'awa, Kehaha, Apr 1919, *Rock* 16040 (BISH); Kokee, Apr 1968, *Herbst* 1076 (BISH); between Makana and Waiahuakua, Dec 1939, *Degener* 17161 (BISH).



*A. koa* exhibits a wide range of variation in such characters as size of mature plants, persistence of juvenile foliage, size and shape of phyllodes and number of branches of the inflorescence. It might be possible to distinguish infraspecific taxa but if this is to be done then the study of herbarium material should be supplemented by field studies throughout the area of distribution of the species. In the Hawaiian Is abrupt changes in topography, rainfall, and soils over short distances have probably led to the development of diverse ecotypes. Whitesell (1964) discussed the ecology and distribution of *A. koa* and decided that considerable ecotypic variation from island to island was probable.

Extreme variants are distinctive and have been formally described: *A. koa* var. *hawaiiensis* and *A. heterophylla* var. *latifolia* for the variant with broad phyllodes and pods from higher altitudes on Hawaii, *A. koa* var. *lanaiensis* for the variant with short obtuse phyllodes from Lanai, and *A. koa* var. *koaia* for the plants with narrow phyllodes and longitudinal seeds, mainly from Maui and Hawaii. There are other distinctive variants as well as many intermediates. Recognition of the extremes does little to elucidate the pattern of variation within the species, and I have followed Skottsberg (1939) in admitting only two species to the Hawaiian flora—*A. kauaiensis* and a polymorphic *A. koa*.

*A. koa* is closely related to *A. heterophylla*. Differences in flowers, fruits, seeds, and development of juvenile foliage were discussed by Vassal (1969). Both species are tetraploid (Atchison, 1948; Vassal) and both resemble *A. melanoxydon* a species widespread in eastern Australia, which is diploid (Atchison).

**5. *Acacia kauaiensis* Hilleb.** Fl. Haw. Is. 113 (1888). Type: Kauai, *Hillebrand* (not seen, presumably B).

Tree to 12 m, usually smaller; branchlets angular glabrous or scurfy or with dense appressed hairs, sometimes extending to pulvinus, sometimes only in patches. Phyllodes falcate with *ca* 3 prominent longitudinal nerves the secondary longitudinal nerves anastomosing, (8–)13–19 cm long, 7–12(–19) mm wide, 9–18(–22) times as long as broad; gland up to 7 mm from base; pulvinus 2–7 mm long. Heads of ?30–45 flowers on peduncles 5–8 mm long densely appressed yellow pubescent in 3–5 branched racemes, the axis 10–13 mm long, scurfy and appressed pubescent, the racemes arranged in  $\pm$  compact terminal panicles *ca* 6 cm long. Flowers 5–merous; calyx 1.4–1.6 mm long, the lobes obtuse, woolly at top, 0.5 mm or more long; corolla 2.2 mm long, 1.2–1.5 times as long as calyx, the lobes free or united to the middle, sometimes pubescent at apex; stamens 4 mm long; ovary tomentose. Pod 12–15 cm long, 17–21 mm broad, seeds transverse, 9.5–10.5 mm  $\times$  4.5–7–7 mm with large open areole and the funicle hardly thickened or folded.

Range: Hawaiian Is.

KAUAI: Waimea Drainage Basin, west side, Jul-Aug 1917, *Forbes* 1073κ & 817κ (BISH); Kumueia ridge near Kokee, Aug 1938 *Cranwell et al.* 2843 (BISH, K); Waimea Canyon, west rim, Jun 1957, *Snow* (BISH); Halemanu, Apr 1929, *Neal* (BISH); Waimea, Na Pali-Kona forest reserve, Aug 1953, *Chock* 882 (BISH, K).

The species is closely allied to *A. koa*, being distinguished from all variants of that species by its inflorescences and hirsute calyx lobes. Skottsberg discussed the difference between the two species. A specimen (*Rock* 2755b from Kaholuamano), labelled as the holotype of *A. koa* var. *kauaiensis* Rock, has been identified as *A. koa*. Rock (1920) treated *A. kauaiensis* as a distinct species.

#### 6. *Acacia simplex* (Sparrman) Pedley, comb. nov., based on

*Mimosa simplex* Sparrman, Nov. Act. Soc. Ups. 3 : 195 (1781), Type: Tanna, *Forster* (BM, holo; P, iso?)

*M. simplicifolia* L.f. Suppl. Pl. 436 (1781), *nom. illegit.* Type as for *M. simplex*.

*M. mangium* Forst.f. Prodr. 75 (1786). Type: Tanna, *Forster* (BM).

*Acacia laurifolia* Willd. Sp. Pl. ed. 4. 4 : 1053 (1806), *nom illegit.* Type as for *M. simplex*.

*A. simplicifolia* (L.f.) Druce, Rept. Bot. Exchang. Club 4 : 602 (1917); Schunz & Guillaum in Sarasin & Roux, Nova Caled. Bot. 152 (1920), *nom. illegit.*

Tree to 10 m; branchlets glabrous, very angular. Phyllodes glabrous, ovate abruptly contracted at base, obtuse, 5–12 cm long, 2.5–7.5 cm broad, 1.4–2.1 times as long as broad; 7–11 prominent longitudinal nerves, with less prominent longitudinal and obscure penninerves between them; gland rather small 2–10 mm from base; pulvinus (not at all well defined) up to 5 mm long. Heads of 25–30 flowers on glabrous peduncles 5–13 mm long, with usually a bract at base, peduncles usually 1–2 on short axis 1.5–4 mm long, two of which usually occur in the axils, or rarely axis so much reduced for the peduncles to appear to be axillary (4 per axil). Flowers 5-merous; calyx 0.7–1.0 mm long, membranous, somewhat irregularly divided into tomentose  $\pm$  linear lobes; corolla 1.3–2 mm long, glabrous 1.8–2.2 times as long as calyx; stamens *ca* 2 mm long; ovary glabrous. Pod glabrous, margin winged, somewhat transversely nerved, raised over seeds alternatively on each side, up to 14 cm long, 10–13 mm broad; seeds longitudinal, 6.5 mm long *ca* 4.5 mm broad with a large closed shield; funicle little thickened, not folded.

Range: Beaches (littoral forest) of Tongan, Samoan, Fijian Islands, New Caledonia and New Hebrides; probably introduced to Solomons.

SAMOA WEST. Savaii: Safotu-Manase, Aug 1931, *Christophersen & Hume* 2460 (BISH, K, P); Savaii: Avau, Jul 1931, *Christophersen & Hume* 1931 (BISH, K); Wallis Is: Nukuifala, Nov 1968, *McKee* 19925 (BISH, P); Hoorn Is: Futiena, Oct 1958, *McKee* 19870 (BISH, P).

TONGA: Vavua, Dec 1891, *Crosby* 58 (K); Lifuka, Apr 1953, *Yuncker* 15745 (BISH); Tongatapu, Sep 1959, *Soakai* 1035 (BISH, K); Eua, Apr 1953, *Yuncker* 15590 (BISH); Fiji: Vanua Levu: Thakaundrove, Jan 1941, *Degener & Ordonez* 14057 (K); Taveuni, May 1969, *Smith et al.* 16901 (BRI, P); Yarhata, Dec 1963, *Koroiveibau* 13939 (BRI); Vanua Mbalavu, Mar 1934, *Smith* 1485 (K, P); Nayau, Jul 1927, *Tothill* 1320 (K); Totoya, Jul 1927, *Tothill* 1326 (K); Ovalau, Nov 1925, *Tothill* 132 (K); Fulanga, Feb 1934, *Smith* 1188 (K, P); New Caledonia: 13 miles SE of Ponerihouen, Aug 1962, *McMillan* 5205 (K); Noumea, *Balansa* 1389 (K); Is de Pines, Oct 1855, *Milne* 136 (K); Without definite locality: *Labillardiere* (P).

NEW HEBRIDES: Eromanga, May 1928, *Kajewski* 330 (BRI, K); Aneityum, Feb 1929, *Kajewski* 695 (BRI, K); Aneityum, Jul 1896, *Morrison* (K).

SOLOMON IS: Santa Cruz, Nov 1945, *Walker* BSI p 208 (BRI, K).

The names *Mimosa simplex*, *M. simplicifolia* and *Acacia laurifolia* were all based on a Forster collection from Tanna. The last two are illegitimate under Article 63 of ICBN because they were nomenclaturally superfluous when published. Linnaeus filius cited *Mimosa simplex* as a synonym in the protologue of *M. simplicifolia* and this name must be used.

*A. simplex* is closely related to the imperfectly known *A. mathuataensis* from Fiji, and also to *A. fleckeri* Pedley ms. which is confined to a small area in Cape York Peninsula, Queensland. *A. fleckeri*, flowering material of which has not yet been collected, has slightly more elongate phyllodes with fewer prominent nerves and narrower pods.

7. ***Acacia mathuataensis*** A.C. Sm. J. Arn. Arb. 31 : 165 (1950). Type: Fiji: Vanua Levu: Mathuata: summit ridge of Mt. Numbiutoa, east of Lambasa, alt. 500–590 m, *A. C. Smith* 6521 (BISH, BRI, K; iso).

Tree to 6 m tall; branchlets very angular, glabrous sometimes with conspicuous lenticels; stipules minute, broad triangular. Phyllodes glabrous, ovate or broad elliptic abruptly narrowed at base but  $\pm$  sessile, 3.5–5 cm long, 15–25 mm broad, 1.5–2.4 times as long as broad; 8–10 prominent longitudinal nerves, with a less prominent secondary longitudinal nerve and obscure penninerves between them; gland small 2–5 mm from base. Heads of ca 40 flowers on glabrous peduncles 5–6 (–7) mm long, usually with a broad bract at the base, peduncles usually 1 (rarely 2) on an axis 1–1.5 mm long. Flowers (4–) 5-merous; calyx 0.7–0.8 mm long, membranous, glabrous with broad obtuse lobes 0.2–0.3 mm long; corolla 1.5–1.6 mm long, twice as long as calyx, divided to about the middle, stamens 2–2.5 mm long, ovary glabrous.

Range: Known only from the type collection.

This is possibly no more than a variant of *A. simplex*, but the phyllodes of the only collection seen are significantly smaller than those of *A. simplex* and there is also a slight difference in the inflorescence. If these differences do not hold when more material is available for examination then *A. mathuataensis* should be reduced to some infra-specific rank. The two species have widely differing ecological requirements.

**8. *Acacia richii*** A. Gray, Bot. U.S. Expl. Exped. 1 : 482 (1854). Type: Herbarium of the U.S. Exploring Exped. under Capt Wilkes (K, P, iso).

Tree to 25 m; branchlets slender, glabrous, quite angular. Phyllodes straight or slightly curved, broadest below the middle attenuate towards the apex; 5–8.5 cm long, 8–19 mm wide, 4–9 times as long as broad, broader and less elongate on young trees; many equally prominent (1.3–1.7 mm) longitudinal nerves, faint reticulations between them; gland small but prominent 2–7 mm from base; phyllodes almost sessile or on broad pulvinus up to 1.5 mm long. Heads of about 10 flowers on glabrous peduncles 4–7 mm long, arranged in two bundles of two (reduced racemes?) in the axils, the peduncle subtended by a short bract. Flowers 5–merous; calyx rather thick, glabrous, 0.6–0.8 mm long, the lobes short and broad, corolla 1.4–1.6 mm long, 2–2½ times as long as calyx, glabrous, deeply divided; stamens *ca* 3 mm long; ovary glabrous. Pods broad, flat, rather papery, slightly winged, transversely nerved, up to *ca* 8 cm long, 12–18 mm broad; seed transverse *ca* 7.5 × 4 mm; funicle scarcely thickened, loosely folded.

Range: Fiji: in rain-forest and open-forest in rainfall up to 5 000 mm (200 in.).

Fiji: Vanua Levu: Mathuata, Nov-Dec 1947, *Smith* 6901 (K, BRI), Nov 1962 *Fijian Dept. Ag.* 12949 (K), and Nov 1928, *Tothill*, 452 (K); Drekati, May 1927, *Mead* (K). Viti Levu: Tholo West, May 1941, *Degener* 15239 (K); Moa, May 1971, *Smith* 4519 (K, BRI); in 1860, *Seeman* (P, K, H). Serua: Taunovo, Oct 1961, *Nasoqiri* FD258 (BRI).

The species is closely related to *A. confusa* but it is also very nearly allied to *A. excelsa* from drier parts of Australia.

**9. *Acacia confusa*** Merrill, Phil. J. Sci. 5 (Bot.) : 27 (1920); Li, Woody Flora of Taiwan 332 (1963). Type: Luzon: Zambales: Subig and vicinity, Apr 1903, *Merrill* 214 (K, iso).

*A. confusa* Merrill var. *inamurai* Hayata, Icon. Pl. Form. 4 : 4 (1914). Type: Koshun: Kuraru, Oct 1913, *Inamara* (not seen).

Tree to 10 m tall; branchlets angular, glabrous, slightly corky. Phyllodes glabrous, slightly curved acute  $\pm$  parallel sided, 6.5–10 cm long, 5–9 mm broad, (7–) 10–14 times as long as broad; several longitudinal nerves prominent, faintly anastomosing between them; gland subbasal or up to 5 mm from base; pulvinus up to 2.5 mm long but phyllodes often subsessile. Heads of *ca* 25 flowers on glabrous peduncles 7–13 mm long, usually with a basal bract, the peduncles in groups of 1–2, with 1–2 groups in each axil, i.e., ranging from 1 to 4 peduncles per axil: if two peduncles then head of one opening before the other. Flowers 5-merous; calyx of membranous lobes, sometimes expanded gradually from the base, often with narrow stipe and broad lamina, 1–1.3 mm long, a few hairs at top, up to 1.5 mm in cultivated specimens; corolla glabrous usually united to middle, 1.5–1.9 mm long, 1.3–1.8 times as long as calyx, sometimes to 2.3 mm long in cultivated specimens; stamens *ca* 3.5 mm long; ovary glabrous. Pods membranous, with almost winged margins, glabrous, transversely nerved, raised over seeds, to 9 cm long, 1 cm broad; seeds longitudinal 5–6 mm long, 3.5–5 mm broad, with a large closed shield; funicle scarcely thickened, not folded.

Range: Taiwan and the Philippines, cultivated and perhaps naturalized elsewhere; for example, China, Micronesia and Hawaii.

TAIWAN: Taihoku (Taipei), Sep 1909, *Kawakami & Shimada* 26 (K) and *Kawakami* (L); Apr 1912, *Price* 37 bis (K); May 1931, *Tanaka & Shimada* (L); Tamsui (Tanshui), in 1864, *Oldham* (K) and Apr 1882, *Hancock* (K).

PHILIPPINES: Luzon: Zambales, Nov 1920, *Amarillas* PBS2823 (L, P); Benguet, in 1925, *Lagasca* PBS30197 (K).

*A. confusa* is closely related to *A. richii* but has narrower, more elongate phyllodes, more reduced inflorescences, larger heads, membranous and deeply divided calyxes and narrower pods with longitudinal seeds. It is also closely related to *A. simsii*.

*A. confusa* is probably not native to the mainland of China though there are specimens from Kweichow and Kwantung provinces in herb. Kew. The species was not recorded from China either by Merrill or by Forbes and Hemsley (1886–8).

**10. *Acacia simsii*** A. Cunn. ex Benth. Lond. J. Bot. 1 : 368 (1842). Type: Cleveland Bay, 2nd Voyage of "Mermaid"  $\frac{211}{1818}$ , *Cunningham* (K, holo.; iso, BM).

Shrub to *ca* 3 m tall; branchlets slender, angular, glabrous, lenticels sometimes conspicuous; stipules somewhat persistent, triangular, up to *ca* 1 mm long. Phyllodes rather membranous, glabrous, punctulate, usually papillose on the margins, straight or sometimes curved, linear, tapered to

each end, acute rarely apiculate 5–11 (–14) cm long, 2–7 mm broad, 13–33 (–50) times as long as broad, plurinerved with 1–3 more prominent than the rest and the others widely spaced, obscure when phyllode is narrow; pulvinus 1–2 mm long; gland small, swelling with a small orifice, always at base of phyllode with 1–5 smaller similar ones along margin. Inflorescence usually an axillary group of flowers (evidently a condensed raceme which may grow out into a leafy shoot) consisting of two pairs of heads, on head of each pair maturing before the other; heads of 25–30 flowers; peduncles glabrous, 5–8 mm long, bracteoles about as long as the calyx. Flowers 5–merous; calyx 0.6–0.8 (–1) mm long, membranous with coarsely fimbriate rounded or obtuse lobes 0.2–0.3 mm long, or lobed to the base; corolla 1.35–1.5 mm long, separating completely or to about the middle into membranous, glabrous, elliptic uninerved lobes  $1\frac{1}{2}$ –2 times as long as calyx; stamens *ca* 3 mm long; ovary glabrous. Pod glaucous, flat with nerve-like margins, raised over the seeds alternately on each side and slightly contracted between them, 5–8 cm long, 4–5 (–7) mm broad. Seeds longitudinal, 3–4 mm long, *ca*  $1\frac{1}{2}$  mm thick, *ca* 3 mm broad, areole pale open or closed; funicle  $\pm$  straight, slightly thickened to form clavate aril beneath seed.

Range: Eastern Australia north of about 20° S latitude, the northern part of the Northern Territory, and New Guinea.

WEST NEW GUINEA: Hollandia district: Cape Tanah Merah, Aug 1961, *v. Royen & Sleumer* 6487 (L, BRI); Cyclops Mountains, Jul 1961, *v. Royen & Sleumer* 6243A (L); Hollandia (Noordwijk) Apr 1957, *Versteegh* BW475 (L, G); Hollandia and vicinity, Jun–Jul 1938, *Brass* 9009 (L, BRI, K).

EAST NEW GUINEA: Western District: Lake Daviumbu, Middle Fly River, Sep 1936, *Brass* 7667 (L, BRI, K); Weam (8.38 S 141.07°E), Jul 1967, *Ridsdale & Galore* NGF33499 (L, BISH, BRI); Morehead (9.00 S 141.25°E), Aug 1968, *Eddowes & Kumul* NGF36045 (L, BISH, BRI); between Morehead and Wassi Kussa R., Dec 1936, *Brass* 8454 (L, K); Wassi Kussa R., (8.57°S 141.59°E), Jul 1968, *Henty & Katik* NGF38750 (L, BRI, K); Wuroi, Orumo River, Jan–Mar 1934, *Brass* 5698 (BRI, K). Central District: Tovobada Hills, 12 miles N of Port Moresby, May 1965, *Heyligers* 1141 & 1172 (L, BRI, K); Tovobada Hills near Waigani Village, 10 miles NNW of Port Moresby, May 1967, *Pullen* 6947 (L, BRI).

*Acacia simsii* occurs only in northern Australia and New Guinea. Its distribution in New Guinea is unusual—on the north coast as well as both east and west of the Gulf of Papua in southern New Guinea. As suggested by Heyligers (1972) *A. simsii* could be a relict which formerly had a larger distribution. It is closely related to *A. confusa* which may have in fact evolved from *A. simsii*.

**11. *Acacia mangium*** Willd. Sp. Pl. 4 : 1053 (1806); Merrill, Inter. Rumph. Herb. Amboin. 251 (1917); Pedley, Proc. Roy. Soc. Qd 74 : 56 (1964).

*Mangium montanum* Rumph. Herb. Amb. 3 : 123.t.81 (1750).

Type: Description and figure in Rumphius's "Herbarium Amboinense".

A tree to 30 m; branchlets acutely trigonous sometimes slightly scurfy but soon becoming glabrous. Mature phyllodes up to 25 cm, 2–4 times as long as broad, glabrous or slightly scurfy; four main longitudinal nerves running together at base of phyllode near dorsal margin, with many fine anastomosing secondary veins, the vein islands elongate (at least three times as long as broad); gland basal; pulvinus glabrous 6–10 mm long. Flowers in rather loose spikes to 8 cm long, single or in pairs in the upper axils; peduncles canescent or pubescent, about 1 cm long; rhachis canescent or pubescent. Flowers 5–merous; calyx 0.6–0.8 mm long, with short obtuse lobes; corolla about twice as long as the calyx. Pods linear glabrous, coiled, 3–5 mm broad; valves membranous or slightly woody, depressed between the seeds. Seeds longitudinal, *ca* 5 mm long, black, nitid, rectangular with the funicle folded and forming a cupular fleshy aril beneath the seed.

Range: Eastern Australia north of about 18° S latitude (but absent from Cape York Peninsula), southern New Guinea, Aroe Is, and southern Moluccas.

SOELA IS: Taliaboe, Tdj. Tege, *Atjeh* 122 (L); Sanana, Aug 1939, Neth. Ind. For. Ser. bb 28863 (K, L). W. Ceram: Kairatu, Waiselang, Jun 1959, *Kuswata & Soepadmo* 204 (BRI, K, L). Aroe: P. Trangan, Kp. Ngaiber, Jun 1938, *Buwalda* 5397 (BRI, K, L) and Neth. Ind. For. Ser. bb25432 (BISH, L).

W. NEW GUINEA. Fakfak: Agonda (Babo) Aug 1941, exped. *Lundquist* 258 (bb 32977) (L); Manokwari: Sidai, Inkoerma Plat., Jul 1956, *Mangold* BW2196 (K, L); along river Digoel, Wage Div., Nov 1957, *Versteegh & Kalkman* BW4848 (L); Merauke: Djidjoeroeg, Mar 1954, *Long* 9 (BW576) (L).

E. NEW GUINEA: Western District: Kiunga sub-dist., Fly River Bulge [7.02° S 140.02° E], Mar 1968, *Millar* NGF35439 (BRI, L); Bensbach sub-dist., near Weam, 8.38° S 141.07° E, Aug 1967, *Ridsdale* NGF33589 (L); near Morehead Patrol Post, Aug 1967, *Pullen* 7151 (BRI, L); Daru sub-dist., Upper Oriomo River 8.55° S 143.10° E, Sep 1963, *Havel* NGF17244 (BISH, BRI, L); Wuroi, Oriomo R., Jan–Mar 1934, *Brass* 5697 (BRI); Oriomo Ag. Stn., Jul 1968, *Womersley* NGF37155 (BISH, BRI, L).

Pollen morphology indicates that *A. mangium* is one of the less advanced species of subg. *Heterophyllum*. The large phyllodes with coarsely reticulate nerves, coarse angular branchlets, linear pods and long spikes are probably also primitive characters. *A. mangium* has no close affinity with any other species dealt with here.

**12. *Acacia crassicarpa*** A. Cunn. ex Benth. Lond. J. Bot. 1 : 329 (1842). Type: Lizard I., Aug  $\frac{119}{1820}$ , *Cunningham* (K, holo; BM, iso).

Tree to about 30 m tall; branchlets angular, scurfy; phyllodes glabrous, curved,  $\pm$  acute, attenuate at base (narrowed gradually into pulvinus) 11–20 cm long, 10–35 (–45) mm broad, 2.5–12 times as long as broad, 3–5 yellowish, longitudinal nerves prominent, tending to run to lower margin

at the base, secondary  $\pm$  parallel nerves not anastomosing; pulvinus (4–) 5–12 (–16) mm long; gland basal, a prominent swelling and small orifice. Spikes moderately dense, 4.5–6 cm long on scurfy peduncles 5–10 mm long in groups of 2–6 in upper axils. Flowers 5–merous; calyx 0.55–0.7 mm long, membranous,  $\pm$  glabrous with scurfy concave lobes; corolla widely spreading, glabrous 1.3–1.6 mm long, 2–2.8 times as long as calyx, lobed to the middle; stamens 2–3 mm long; ovary shortly pubescent, hairs denser at top. Pod woody, flat, glabrous, transversely but hardly reticulately nerved, to 5 cm long, 20–35 mm broad. Seeds transverse, 5–6 mm long, 2–3 mm broad; areole large, constricted towards the base and therefore almost closed; funicle thickened and folded forming a long aril beneath the seed.

Range: Coastal Queensland north of about 20° S latitude and the western part of eastern New Guinea.

E. NEW GUINEA: Western District: 9°00' S 143° E, Jun 1960, *McVeagh* NGF13195 (BRI, K, L); Oriomo Ck, mouth of Yakup Ck, 40 miles from sea, 8°50' S 143° E, Sep 1963, *Womersley* NGF17758 (BRI, L); 3 miles SE Morehead Patrol Post, Aug 1967, *Pullen* 7123 (BISH, BRI, L); Morehead sub-dist., Mai Kussa R., 8°59' S 142°15' E, Jul 1968, *Henty & Katik* NGF38776 (BRI, K, L); Wassi Kussa R., Dec 1936, *Brass* 8699 (BRI, K, L); Bensbach sub-dist., Weam 8°38' S 141°07' E, Aug 1967, *Ridsdale* NGF33590 (BISH, BRI, L); Wuroi, Oriomo River, Jan–Mar 1934, *Brass* 6024 (BRI) and 6017 (BRI, K).

*A. crassicarpa* is closely related to, and often confused with *A. aulacocarpa*. *A. crassicarpa* has usually larger phyllodes, often with a yellowish tinge on the margins and nerves, on a longer pulvinus. Its pods are slightly woodier, more regular in shape and broader. White (1964) did not think *A. crassicarpa* to be specifically distinct from *A. aulacocarpa* and referred it to *A. aulacocarpa* var. *macrocarpa* Benth. There is some uncertainty about the identity of var. *macrocarpa* but no doubt that *A. crassicarpa* and *A. aulacocarpa* are distinct species.

In northern Queensland and New Guinea *A. crassicarpa* and *A. aulacocarpa* are more or less sympatric but in Queensland *A. aulacocarpa* occurs on somewhat moister sites. Collectors' notes do not suggest that such an ecological segregation applies in New Guinea.

**13. *Acacia aulacocarpa*** A. Cunn. ex Benth. Lond. J. Bot. 1 : 378 (1842). Syntypes: Port Bowen, July  $\frac{115 \text{ \& } 116}{1820}$ , *Cunningham* (K; BM, iso).

Tree to 35 m (rarely more than 15 m in Australia); branchlets slender angular somewhat hoary, rarely glutinous. Phyllodes glabrous, straight or flacate, acute or subacute, 7–15 cm long, 6–25(–30) mm broad, 4–12 times as long as broad, usually 3 prominent longitudinal nerves somewhat crowded towards the lower margin at the base and numerous  $\pm$  parallel secondary nerves, not anastomosing; pulvinus 4–7 mm long; gland basal, prominent



swelling and small orifice. Spikes usually at least moderately dense 2–5.5 cm long, on scurfy peduncles 2–7 mm long, single or in pairs at the base of rudimentary axillary shoots. Flowers 5–merous; calyx 0.7–1 mm long, membranous with broad obtuse scurfy lobes 0.2–0.3 mm long; corolla 1.5–1.9 mm long, lobed to the middle, glabrous, about twice as long as the calyx; stamens 2.5–3 mm long; ovary scurfy or shortly pubescent. Pod glabrous, the valves coriaceous or slightly woody (but not as woody as in *A. crassicarpa*), transversely veined, straight or twisted when old, up to 8 cm long, *ca* 2 cm broad. Seeds transverse *ca* 5.5 mm long, 2.5 mm broad, shield large, open, funicle rather broad folded *ca* five times beneath seed.

Range: Eastern Australia at least as far south as the Richmond River, northern part of the Northern Territory, and southern New Guinea.

W. NEW GUINEA: Merauke: Djidjoeroeg, Mar 1954, *Long* BW575 (L); Koerik, Apr 1957, *Leefers* BW3240 (L).

E. NEW GUINEA: Western District: Lake Daviumbu, Middle Fly R., Sep 1936, *Brass* 7673 (BRI, L); Tarara, Wassi Kussa R., Jan 1937, *Brass* 8718 (BRI, L); Oriomo Sawmill, 8.50°S 143.10°E, in 1960, *McDonald* NGF13013 (BRI, K, L); Oriomo R., Feb 1953, *Hart* NGF5015 (BISH, BRI, K, L) and Dec 1950, *Jackson* NGF2736 (BRI, L), Upper Oriomo R., 8.55°S 143.10°E, Sep 1963 *Havel* NGF17257 (BISH, BRI, L).

**14. *Acacia auriculiformis* A. Cunn. ex Benth. Lond. J. Bot. 1 : 377 (1842). Type: South Goulburn I., Voyage of "Bathurst", *Cunningham* (K, holo).**

Tree to 25 m with hard furrowed bark; branchlets angular, glabrous. Phyllodes similar in texture and shape to those of *A. aulacocarpa*, 10–16 cm long, (12–)15–20(–30) mm broad, 4–8(–10) times as long as broad; 3 prominent longitudinal nerves, running together towards lower margin or in middle of the lamina at the base, many fine crowded, somewhat anastomosing secondary nerves; pulvinus 4–5 mm long; gland basal, distinct swelling and small rimmed orifice at distal end. Spikes somewhat interrupted up to 8 cm long on peduncles 5–8 mm long in pairs in the upper axils. Flowers 5–merous; calyx glabrous 0.7–1 mm long, shortly lobed; corolla 1.7–2 mm long, 2–2½ times as long as the calyx; stamens *ca* 3 mm long; ovary densely pubescent. Pod flat, rather woody, glaucous, transversely veined with undulate margins, *ca* 6.5 cm long, 15 mm broad; seeds transverse *ca* 5 mm long, 3.5 mm wide; areole large, almost closed; funicle completely encircling seed.

Range: Australia north of about 14°S latitude in Queensland and the Northern Territory, New Guinea, south of the central cordillera except for one locality in the East Sepik District, and the Kei Islands.

S.E. MOLUCCAS: Kei Is, *Taheri* (L); Tocal, Mar 1922, *Jensen* 40 (L).

WEST NEW GUINEA: Merauke, N. G. Exped 1904–5, *Koch* 675 (mixed with *Melaleuca cajuputi*) (L); Senajoe [near Merauki], Jul 1941, *Anta* 132 (exped. Wentholt) (K, L); along R. Maro between Merauke and Tajam, Aug 1957, *Kalkman* BW3719 (L).

EAST NEW GUINEA: East Sepik District: Ambunti subd. Yentehan, 4·05° S 142·15° E, May 1969, *Millar* NGF37350 (BRI, L); Western District: near Weam, 8·38° S 141·07° E, Jul 1967, *Ridsdale* NGF33558 (BISH, BRI, L); Daru I., Mar 1936, *Brass* 6391 (BRI, L) and Aug 1971, *Streimann* LAE 51706 (BISH); Saibai I., May 1911, *Bick* (BRI); Gulf District: Kerema, Mar 1926, *Brass* 1219 (BRI, K). Central District: Aroa R., Feb 1935, *Carr* 11425 (K, L); Kanosia, Feb 1935, *Carr* 11223 (K, L); 8 miles W of Kanosia, Jul 1962, *Darbyshire* 609 (BRI, CANB, G, K, L); 8 miles SE of Karema, Brown R., Jul 1962, *Schodde* 2617 (BRI, CANB, G, K, L); Brown River road, 17 miles from Port Moresby, 9·15° S 147·02° E, Apr 1966, *Eddowes & Maru Kummul* NGF13131 (BRI, L); E. Tovobada Hills, 12 miles N of Port Moresby, May 1965, *Heyligers* 1246 (BRI, K, L); Port Moresby, Dec 1925, *Brass* 856 (BRI, K).

*A. auriculiformis* is closely related to both *A. aulacocarpa* and *A. crassicarpa* but differs from both in having narrower pods extremely undulate when immature and seeds encircled by their funicles. It has a wider extra-Australian range than its relatives.

**15. *Acacia wetarensis*** Pedley, species nova affinis *A. auriculiformis* A. Cunn. ex Benth. phyllodiis minus elongatis nervis secundariis subtiliter reticulatis, spicis brevibus et calycibus brevioribus differt. Typus: *Elbert* 4446 (L, holo; BISH, K).

Arbor; ramuli angulati glabri vel furfuracei. Phyllodia glabra acuta, margine infero recto curvatove, supero curvato interdum indentato ad nervorum longitudinalium prominentium cum margine juncturam, 5–12 cm longa, 14–32 mm lata, 2·5–4·5-plo longiora quam lata; nervi longitudinales prominentes quatuor, circiter totidem minus prominentes, omnes basi cum margine ventrali aliquantum concurrentes, inter eis nervis multis secundariis subtiliter reticulatis; basi glans parvus aureomarginatus; pulvinus 5–9 mm longus. Spicae aliquantum sparsiflorae, ca 2 cm longae pedunculo (5 mm longo) rhachidique glabro. Flores 5-meri; calyx late cylindraceus glaber sinuolate lobatus, 0·4–0·5 mm longus; corolla membranacea profunde lobata 1·2–1·5 mm longa; stamina ca 2·5 mm longa; ovarium tomentosum. Legumen (immaturum) ca 5 cm longum 1·3 cm latum, marginibus alatis undulatis (simulans ea *A. auriculiformis*); semina probabiliter transversa.

Tree; branchlets angular, glabrous or scurfy. Phyllodes glabrous acute, the lower margin straight or curved, the upper curved, sometimes indented at the junction of the prominent longitudinal nerves with the margin, 5–12 cm long, 14–32 mm broad, 2·5–4·5 times as long as broad; four prominent longitudinal nerves, about the same number less prominent, all concurrent with the ventral margin at the base, many finely reticulate secondary nerves between them; gland small yellow-margined at the base; pulvinus 5–9 mm long. Spikes somewhat sparsiflorous, ca 2 cm long with peduncle (5 mm long) and rachis glabrous. Flowers 5-merous; calyx broadly cylindrical, glabrous, sinuolately lobed, 0·4–0·5 mm long; corolla membranous deeply lobed 1·2–1·5 mm long; stamens ca 2·5 mm long; ovary tomentose. Pod (immature) ca 5 cm long, 1·3 cm broad with winged undulate margins (similar to those of *A. auriculiformis*); seeds probably transverse.

Range: Wetar.

WETAR: Iliwaki, Feb 1910, *Elbert* 4351 (BISH, BRI, K, L) and Apr 1939, *Neth. Ind. For. Ser.* bb 27253 (K, L); Laswerang N. von Iliwaki, Feb 1910, *Elbert* 4446 (BISH, K, L); 24 km walk N of Iliwaki, along Meta Lerai, Apr 1939, *Bloembergen* 3564 (L); Ilmedo an der Sudkuste, Mar 1910, *Elbert* 4667 (K).

*A. wetarensis* is related to *A. auriculiformis* but even sterile specimens can be distinguished by the finely reticulate secondary nerves. The plant is confined to Wetar where it occurs in strand vegetation or communities dominated by *Eucalyptus alba* up to about 600 m altitude. The species is mentioned briefly, as "e lasi", by Bloembergen (1940).

**16. *Acacia leptocarpa*** A. Cunn. ex Benth. Hook. Lond. J. Bot. 1 : 376 (1842). Lecto-type: Cape Flinders, Aug  $\frac{118}{1820}$ , *Cunningham* (K; BM, iso).

Tree to 12 m; branchlets glabrous, angular but soon becoming terete. Phyllodes usually falcate, acute, attenuate at the base, glabrous, (10-)12-21(-26) cm long, 10-22 (-26) mm broad, 6-15 (-17) times as long as broad, three longitudinal nerves prominent, yellowish, crowded into basal part of phyllode, secondary nerves  $\pm$  parallel, rather widely spaced, anastomosing; gland basal, prominent swelling and small orifice, usually not rimmed; pulvinus (3-) 5-10 mm long. Spikes moderately dense, 5-7 cm long, rhachis glabrous, on glabrous peduncles 3-5 mm long, in pairs at base of rudimentary axillary shoot. Flowers 5-merous; calyx 0.75-1 mm long, stout, subglabrous except for a few fringing hairs, the lobes 0.2-0.3 mm long; corolla glabrous 1.9-2.4 mm long, 2-2.6 times as long as calyx, deeply lobed; stamens 0.3-4 mm long; ovary densely pubescent. Pod linear, somewhat coiled, flat but raised over the seeds, up to 12 cm long, 3 mm broad; seeds longitudinal, *ca* 4 mm long, 2.5 mm broad; areole oblong open; funicle yellow, folded many times forming aril almost as long as seed.

Range: Coastal districts of Queensland (north of 25° S latitude) and the Northern Territory, and southern New Guinea.

WEST NEW GUINEA: Animanzazin, Aug 1941, *Anta* 184 (exped. Wentholt) (K); road to biv. Tamerik, Aug 1941, *Anta* 214 (exped. Wentholt) (L).

EAST NEW GUINEA: Western Division: Weam, 8.38° S 141.07° E, Jul 1967, *Ridsdale* NGF33543 (BISH, BRI, L); nr Bula, mouth of Morehead River, Aug 1967, *Pullen* 7006 (BRI); Tarara, Wassi Kussa R., Dec 1936, *Brass* 8531 (BRI, L); Gaima Lower Fly River, Nov 1936, *Brass* 8257 (BRI, K, L).

*A. leptocarpa* is a smaller tree that grows in more open situations (grassland and open woodland) than the other juliflorous species that occur in southern New Guinea.

17. *Acacia spirorbis* Labill. Sert. Austr. Caled. 69.t.69 (1825). Type: New Caledonia, *Labillardiere* (G(?), K, P, iso).

Tree to 5m; branchlets slender, angular, glabrous. Phyllodes glabrous attenuate at base, falcate, 6.5–11 cm long, 7–15.5 mm broad, 7–12 times as long as broad; major nerves 2, 1 when narrow, occasionally 3 when broad, many secondary longitudinal nerves somewhat anastomosing; gland small basal or subbasal; pulvinus 2–4 mm long. Spikes open 3–5 cm long on glabrous peduncles 3–10 mm long, in pairs in upper axils, rachis glabrous. Flowers 5-merous; calyx 0.8–0.9 mm long, sinuately lobed, cylindrical; corolla glabrous, 2–2.1 mm long, lobed to middle and strongly reflexed, 2.3–2.5 times as long as calyx; stamens *ca* 2.5 mm long; ovary tomentose. Pods flat and obliquely nerved when immature (cf. *A. aulacocarpa*), rather woody, shining and without nerves when mature, coiled, *ca* 5 cm long, 8–10 mm broad; seeds longitudinal or slightly oblique, *ca* 5 mm long and 2.5 mm broad; areole large open; funicle with about 4 folds, embracing base of seed.

Range: New Caledonia and Loyalty Is.

NEW CALEDONIA: Noumea, Oct 1868, *Balansa* (K), Oct 1923, *White* 2133 (BRI, K), and Aug 1930, *Franc* 2467 (BRI, K); Anse Vata, Sep 1954, *McKee* 998 (K); Ile des Pins, Jul 1965, *Bernardi* 10065 (G); north bank of Toutouta R., near junction with Kalouehola, Oct 1955, *McKee* 3297 (K). Without definite locality, *Labillardiere* (G, K, P).

LOYALTY IS: Lifou, in 1926, *Begeret* 15 (G).

The species is closely related to *A. solandri* but differs in having a broad pod. Young pods have transverse veins and show some resemblance to those of *A. aulacocarpa*.

18. *Acacia solandri* Benth. Fl. Aust. 2 : 406 (1864). Type: Bay of Inlets, *Banks & Solander* (BM, holo).

Tree to *ca* 12 m tall with slender, angular, glabrous branchlets. Phyllodes glabrous falcate, tapered equally to each end or broadest above the middle, 9–17 cm long, 6–16 mm broad, 9–22 times as long as broad; two major longitudinal nerves, sometimes concurrent with each other or running into ventral margin near the base and many crowded somewhat anastomosing secondary nerves; gland basal or subbasal; pulvinus 2–4 mm long. Spikes open 3–8 cm long with glabrous rachis, on glabrous peduncles 5–10 mm long in axillary pairs. Flowers 5-merous; calyx cylindrical, glabrous, 0.8–1 mm long, sinuately lobed; corolla 1.8–2.5 mm long, glabrous divided to middle with lobes strongly reflexed, 2–2.5 times as long as calyx; stamens 2.5–3.5 mm long; ovary densely pubescent. Pod flat, sometimes raised over the seeds, glabrous, coiled up to 10 cm long, 3.5–5.5 mm broad; seeds longitudinal or slightly oblique when pod broad, seeds 3.5–5 mm × 2–3.4 mm, areole very large, open; funicle folded many times beneath seed forming aril almost as long as seed.

**(a) *A. solandri* subsp. *solandri***

Phyllodes usually broadest above the middle; spikes up to 8 cm long; pod 3.5–5 mm broad with longitudinal seeds  $5 \times 2.5\text{--}3.5$  mm.

Range: Central Queensland coast (22°–24° S lat.) especially the continental islands, once collected in New Guinea.

EAST NEW GUINEA: Aroa Island, sandy woods behind sea beach, Feb 1935, *Carr* 11424 (K, L).

**(b) *A. solandri* subsp. *kajewskii* Pedley, subsp. nov.**

*A. spirorbis* auct. non Labill.; Guillaumin, *J. Arnold Arb.* 12:248 (1931).

*A. sp. aff. A. spirorbis* Labill.; Guillaumin l.c. 249 (1931).

Phyllodia basem et apicem pariter angustata; spicae usque 5 cm longae; legumen 4–5.5 mm latum seminibus longitudinalibus vel leviter obliquis 3.5–4.5 mm longis, 2–2.5 mm latis. Typus: (*Kajewski* 249; BRI, holo; K, iso).

Phyllodes narrowed equally to base and apex; spikes up to 5 cm long; pod 4–5.5 mm broad with longitudinal or slightly oblique seeds 3.5–4.5 mm long, 2–2.5 mm broad.

Range: New Hebrides.

NEW HEBRIDES: Aneityum, Anelgauhat Bay, Jun 1896, *Morrison* (K) and Feb 1929, *Kajewski* 727 (BRI, K); Eromanga, Dillon Bay, May 1896, *Morrison* (K) and May 1928, *Kajewski* 249 & 285 (BRI, K); Eromanga, Jul 1930, *Cheeseman* 10 (K).

As circumscribed here *A. solandri* has a sporadic distribution around the Coral Sea. The Queensland and New Hebrides populations are distinct and have been isolated for a long time.

Guillaumin referred the *Kajewski* collections to *A. spirorbis* and *A. sp. aff. A. spirorbis*. They all represent a single taxon somewhat intermediate between *A. spirorbis* and *A. solandri* but closer to the latter, though in fact the narrower pods and somewhat more elongate phyllodes are the only characters that distinguish *A. solandri* from *A. spirorbis*. Further study may provide grounds for treating the two subspecies of *A. solandri* as subspecies of *A. spirorbis*.

**EXCLUDED SPECIES**

***Acacia quadrilateralis* DC.** *Prod.* 2 : 451 (1825). Type: Sieber 442 (G–DC, holo; BM, G, K, L, iso).

Decaisne (*Herb. Timor Descr.* 132) recorded *A. quadrilateralis* from Timor. At the request of Dr. C. G. G. J. van Steenis, Dr. H. Heine (P) examined the specimens on which the record was based. He reported (in litt): “There are four sheets of the gathering of *Acacia quadrilateralis* from “Timor” at P: one under *A. juncifolia* Benth., three under *A. pugioniformis* Wendl. The specimen under *A. juncifolia* and the specimen on top of the three specimens under

*A. pugioniformis* bear the highly characteristic labels of the Leschenault collection, on slightly bluish paper, with <Timor> in the left bottom corner, although the name of Leschenault does not appear on these two labels (it is usually written, in other cases I know, in the right bottom corner). Both these labels are annotated by Decaisne: the one *Acacia quadrilateralis* DC. prod., the second one *Acacia quadrilateralis* DC. prod. Sieb. n.H. no. 442. This is no doubt the specimen quoted by Decaisne in *Herb. Timor.* 132 (1835). The original Leschenault label bears the remark on plutot Nlle Hollande after the usual <Timor>.

Dr. Heine considered it likely that the annotation "on plutot Nlle Hollande" had been written by either Leschenault himself or one of his three gardeners. He also noted the enforced stay of Bauden's expedition in Timor because of the state of M. Leschenault's health and concluded that Decaisne's record of *Acacia quadrilateralis* is due to a confusion of labels (or better: localities written on labels) which happened most likely even before the relevant specimens reached Europe.

*A. quadrilateralis* is a common species in coastal districts of south-eastern Australia as far north as about Bundaberg, but it does not occur in tropical Australia and is most unlikely to occur in Timor.

***Acacia willardiana*** Rose, *Contrib. U.S. Nat. Herb.* 1 : 88 (1890) based on *Prosopis* (?) *heterophylla* Benth. *Lond. J. Bot.* 5 : 82 (1846). Type: Mexico: Sonora, in 1830, *Coulter* (TCD holo, photo BRI).

*Senegalia heterophylla* Britton & Rose, *North Amer. Fl.* 23 : 114 (1928). based on *Prosopis* (?) *heterophylla* Benth.

MEXICO: Sonora: Guaymas, Apr & Jul 1890, *Palmer* 164 (ARIZ), Apr 1951, *Phillips* 3488 (ARIZ) and Apr 1971, *Krizman* (ARIZ); 15 miles S of La Palma between La Palma and Guaymas, Sep 1941, *Wiggins & Rollins* 233 (ARIZ); 2 km NW of La Colorada on road to Hermosillo, 28°08' N 110°06' W, Jul 1971, *Hastings* 71-215 (ARIZ). Gulf of Mexico: Tiburon I., Arroyo de la Cruz, 28°46' N 112°22' W, Apr 1966, *Moran* 13006 (ARIZ).

Vassal and Guinet (1972) included *A. willardiana* in subgenus *Heterophyllum*. They stressed the importance of characters they considered primitive. Considerable emphasis was placed on the fact that the petiole of *A. willardiana* is flattened horizontally with the gland situated on the plane surface, not on the edge. They noted that the phyllodes of *A. leptospermoides* Benth. are of a similar structure and suggested a "*willardiana-leptospermoides* line". Dorsally flattened phyllodes with a gland on the upper surface occur in other Western Australian species, *A. blakelyi* Maiden, *A. dielsii* Pritzell, *A. ericifolia* Benth. and *A. sulcata* R.Br., as well as in *A. leptospermoides*, but there is no indication that these are "primitive" species or that they are closely related to *A.*

*willardiana*. Rather than being primitive, "diaphyllo-dization" (the term used by Vassal and Guinet) in subg. *Heterophyllum* may in fact be an advanced character. The phyllodes of the Australian species have a flat lamina, sometimes with a complex system of nerves associated with the gland which varies considerably, even on a single specimen, in its distance from the base, and a well defined narrower pulvinus or "petiole". On the other hand the petioles of *A. willardiana* have no distinct pulvinus and no unusual complex of nerves associated with the gland which is invariably at the apex.

At least some of the characters regarded as primitive by Vassal and Guinet occur throughout the genus; while others suggest that *A. willardiana* should be referred to subg. *Aculeiferum*. Vassal (1971) found funicles of type A1 (which I consider is as far as his classification of funicle-types should be taken) in 13 species of subg. *Acacia*, four of subg. *Aculeiferum* and four of subg. *Heterophyllum*. Seeds of type III (Vassal, *op. cit.*) were found to be commonest in subg. *Aculeiferum* (4 species) and less so in subg. *Acacia* (2 species) and subg. *Heterophyllum* (1 species). The teguments of the seeds are thinner than any other previously examined by Vassal but he found the thinnest teguments in subg. *Aculeiferum* (5 species) and subg. *Heterophyllum* (2 species). Dehiscent pods occur generally throughout the genus and the great majority of the species of subg. *Heterophyllum* and many of subg. *Aculeiferum* lack spines, so that neither dehiscent pods nor the lack of spines indicates primitiveness.

Some of the characters, however, indicate that *A. willardiana* may be accommodated without difficulty in subg. *Aculeiferum*. The structure of the pollen, especially the absence of furrows, the structure of the inflorescence, the pedicellate flowers (not known in subg. *Heterophyllum*), and contrary to the observations of Vassal and Guinet, the presence of stipitate globular glands about 0.8 mm in diameter on the anthers, also suggest that *A. willardiana* is related to American species of subg. *Aculeiferum*.

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